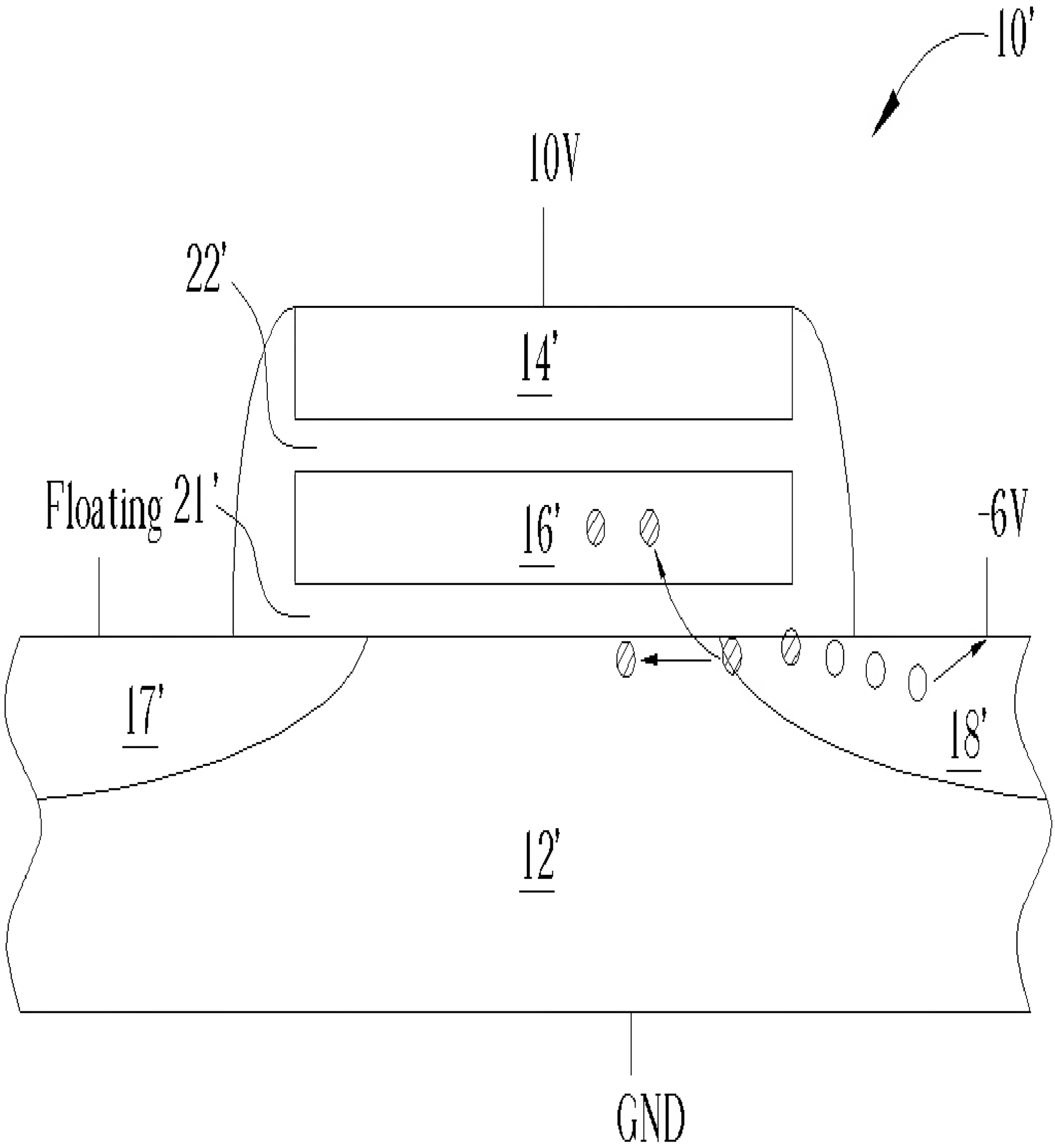


Fig. 1 Prior art

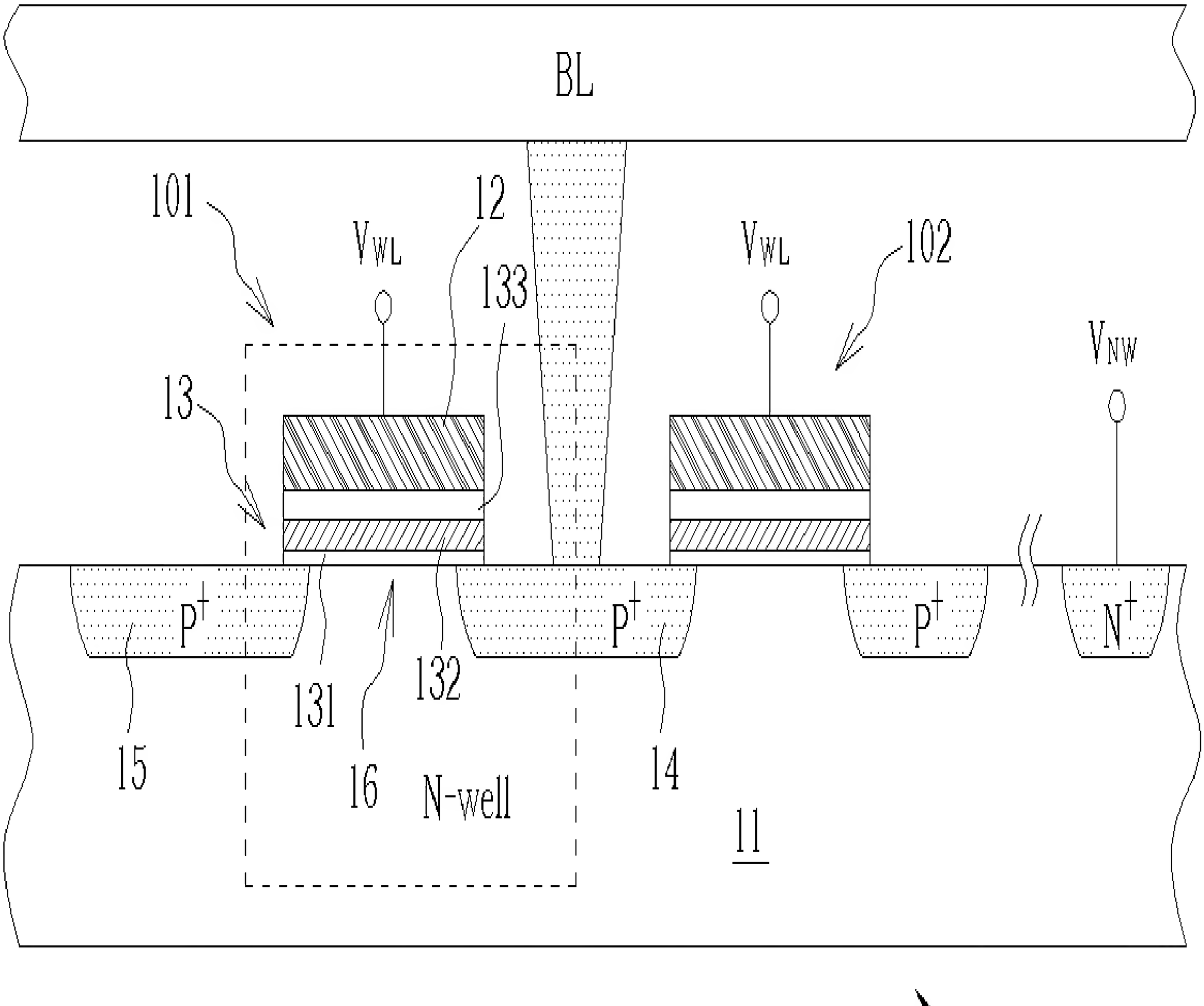


Fig. 2

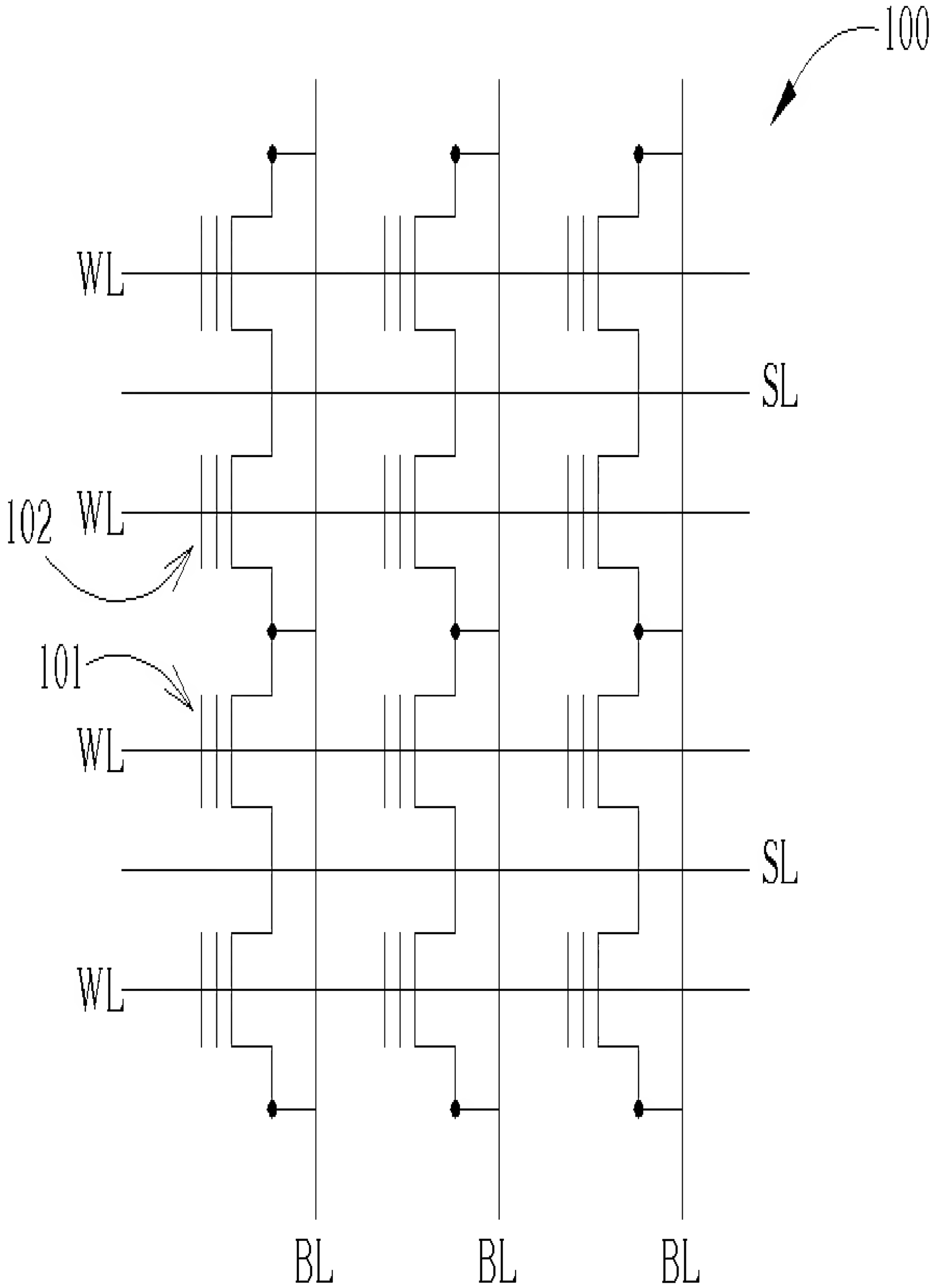


Fig. 3

PROGRAM OPERATION

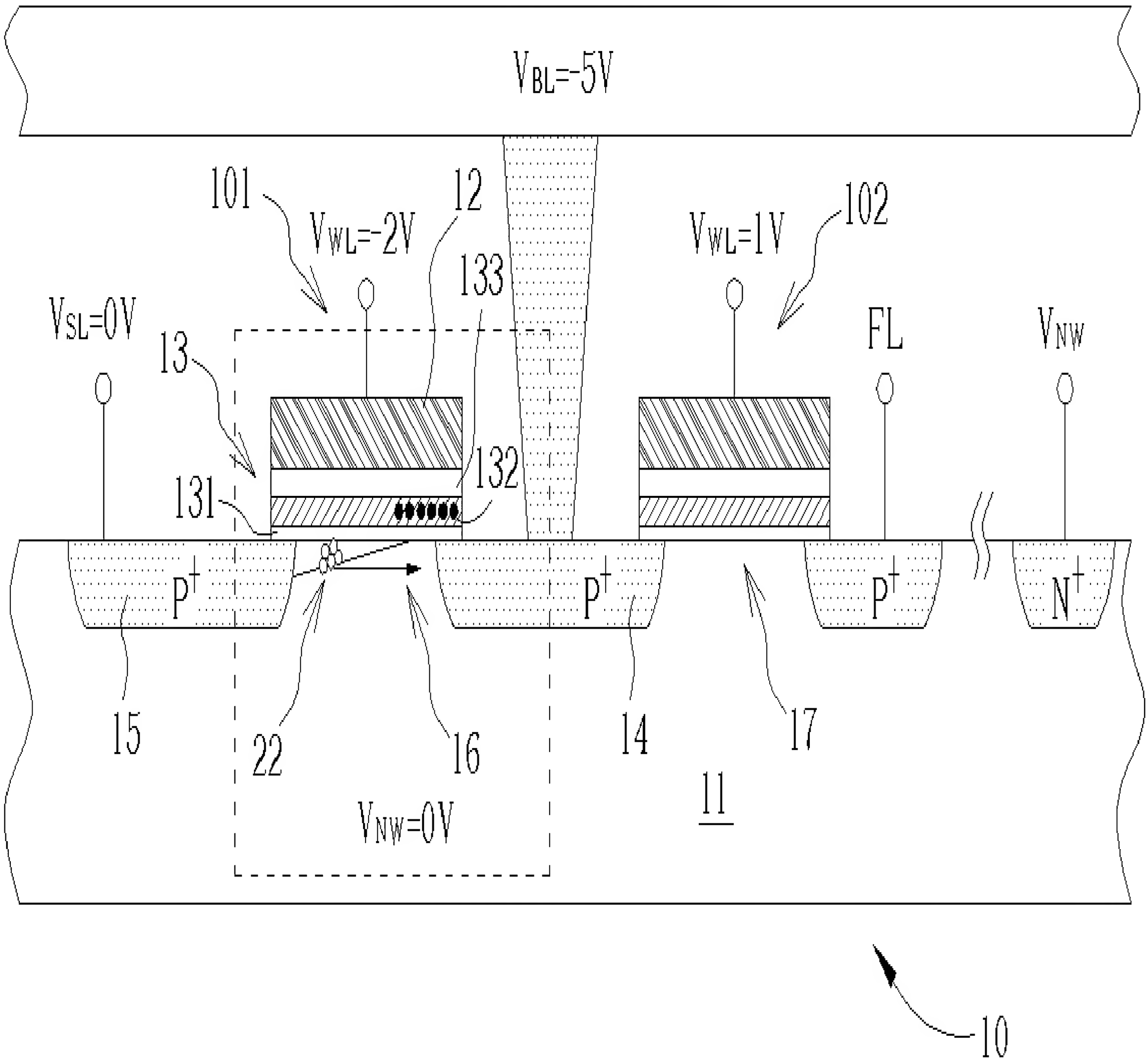


Fig. 4

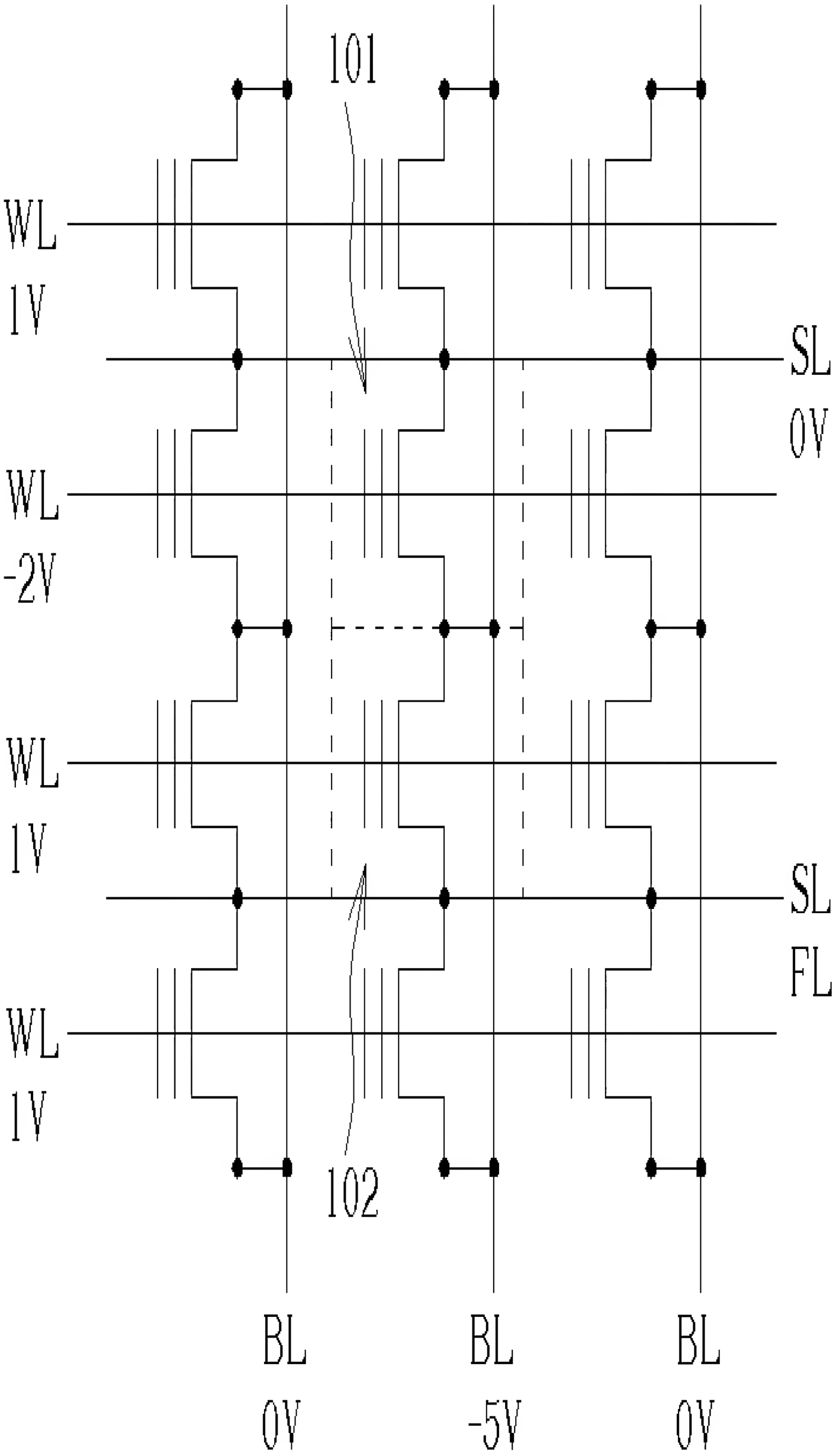


Fig. 5

READ OPERATION

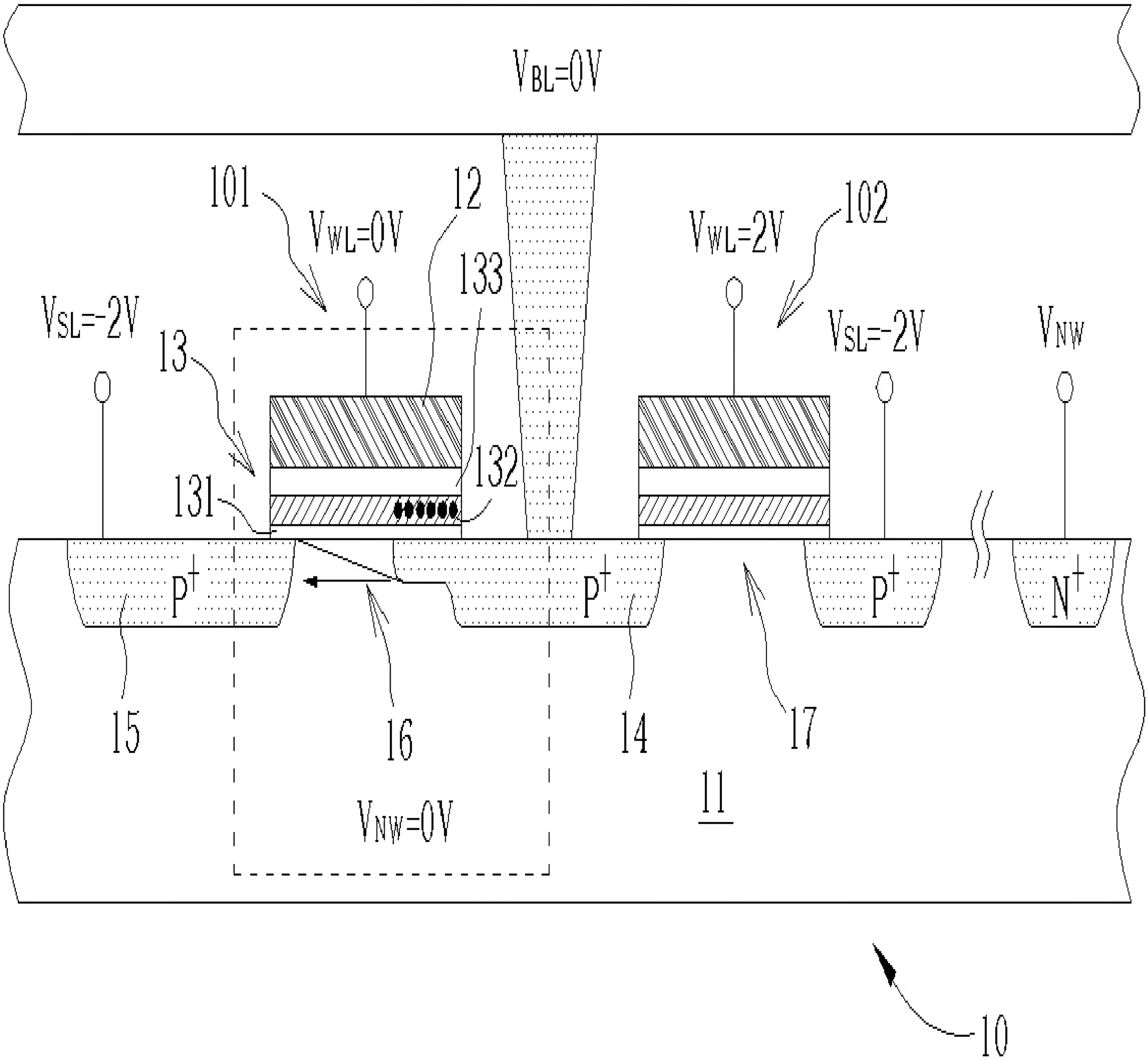


Fig. 6

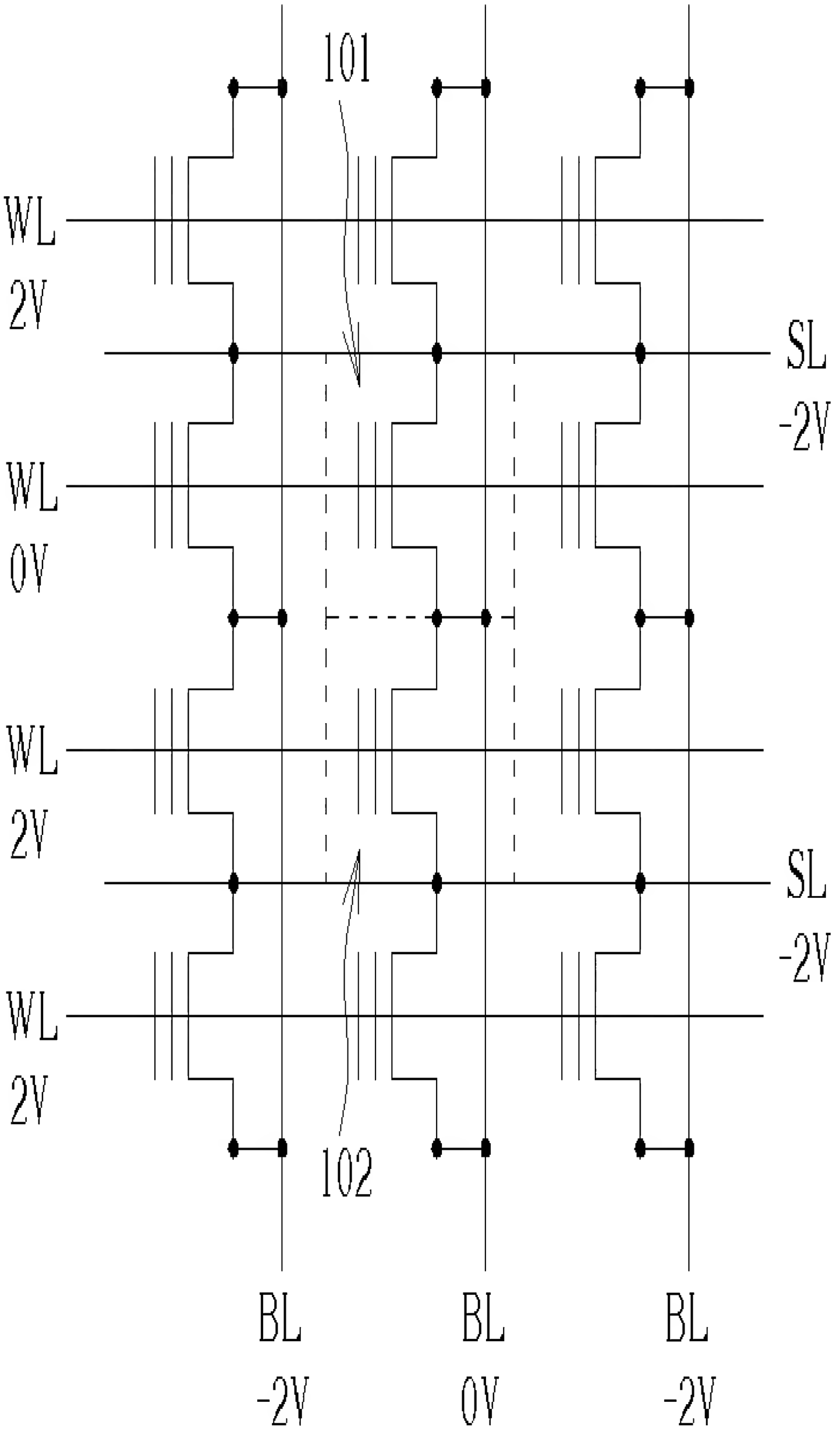


Fig. 7

OPERATION VOLTAGE TABLE

	Selected BL			Un-Selected BL			
	V_{WL}	V_{BL}	V_{SL}	V_{WL}	V_{BL}	V_{SL}	V_{NW}
PROGRAM	-2V	-5V	0V	1V	0V	FL or 0V	0V
ERASE	-6V	0V	0V	0V	0V	0V	6V
READ	0V	0V	-2V	2V	-2V	-2V	0V

Fig. 8

PROGRAM OPERATION

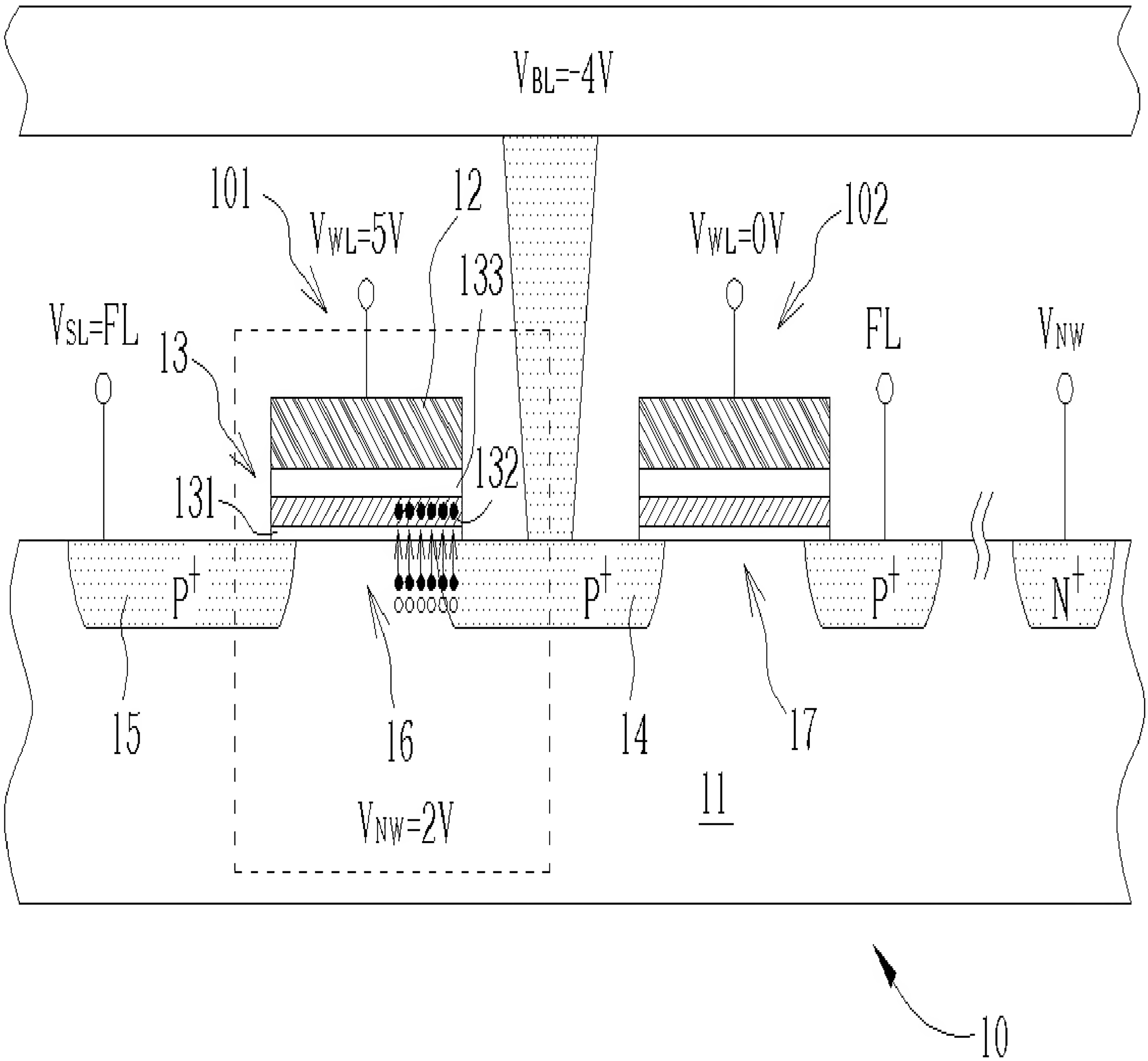


Fig. 9

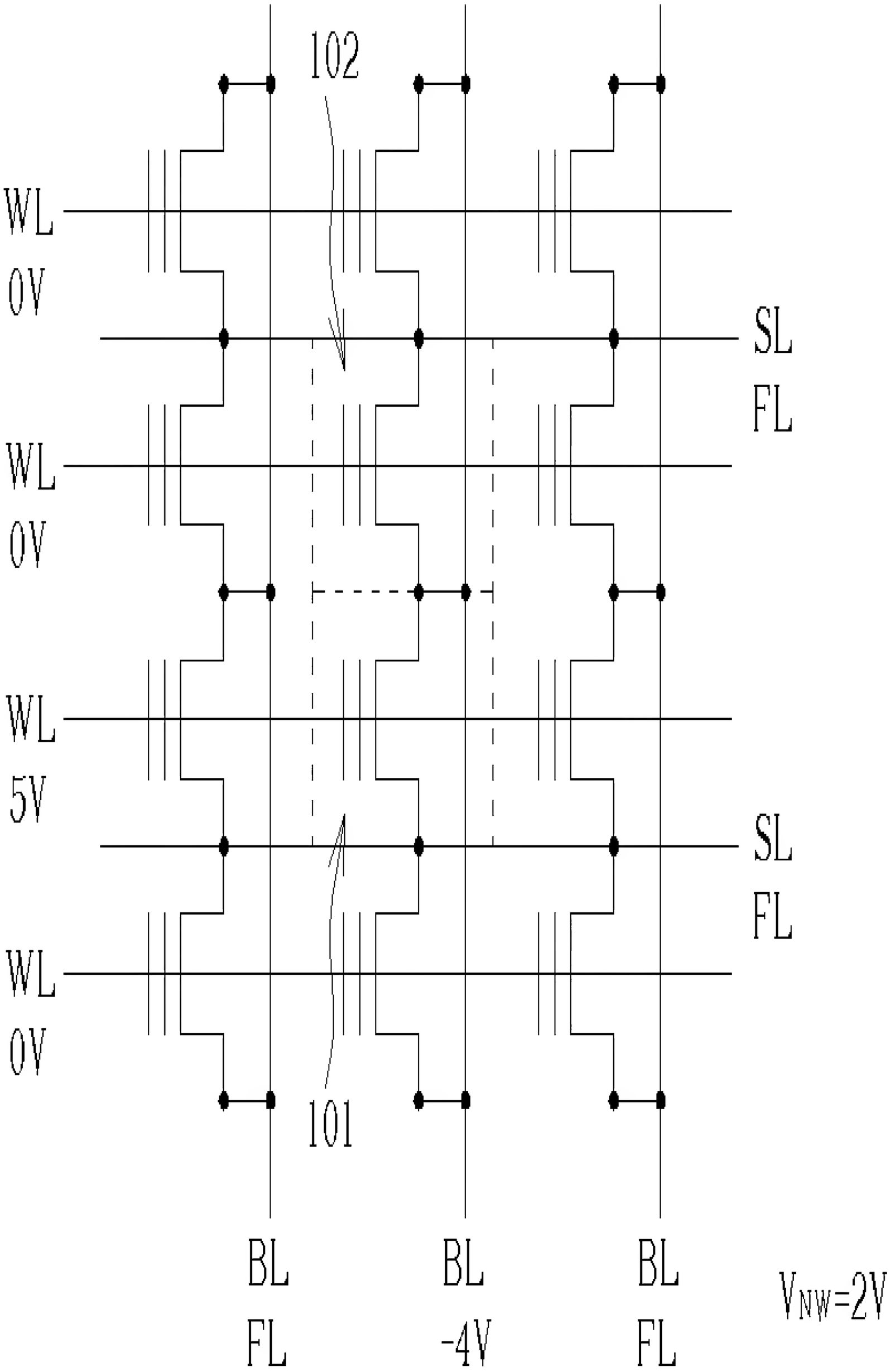


Fig. 10

READ OPERATION

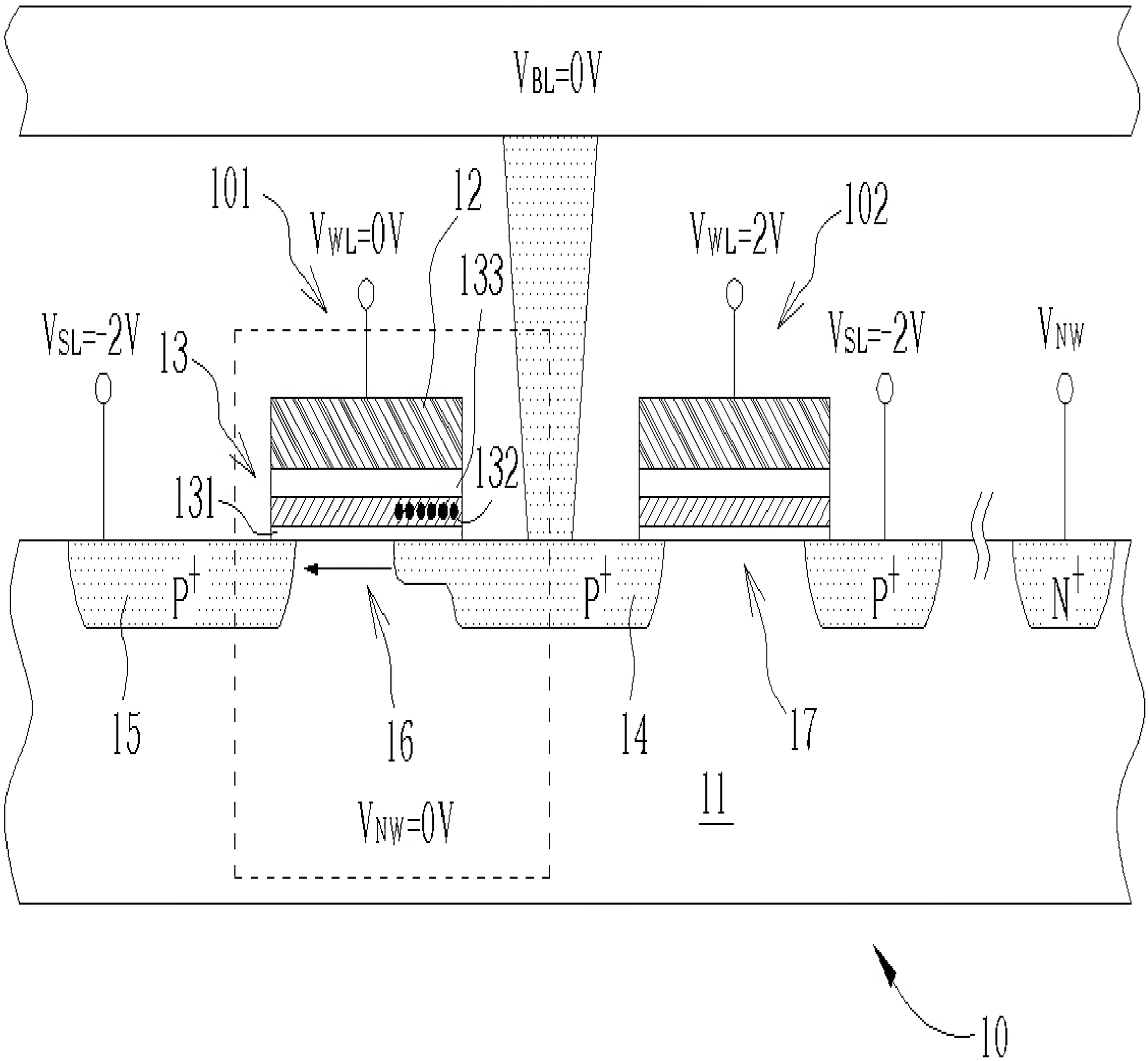


Fig. 11

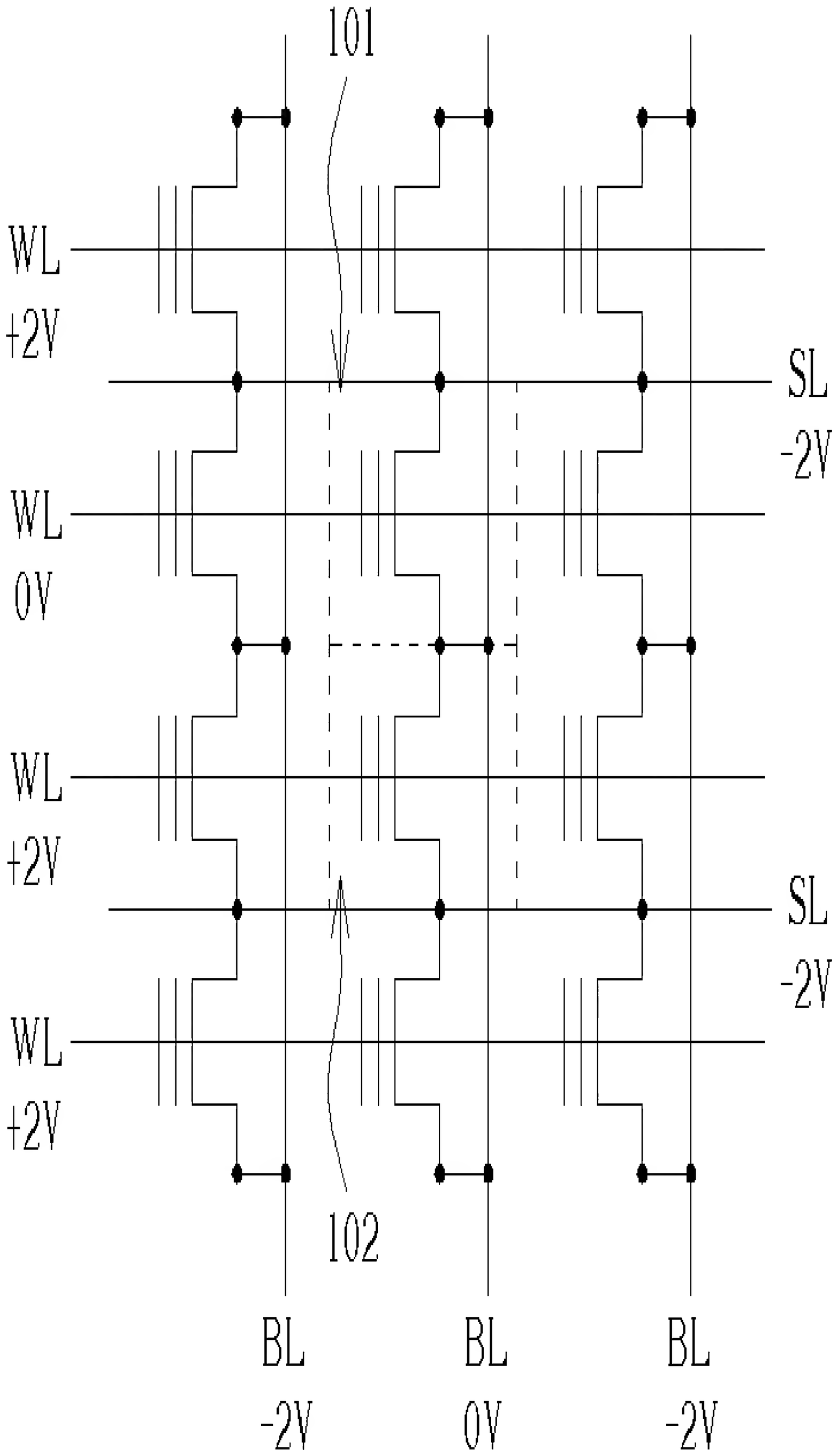


Fig. 12

OPERATION VOLTAGE TABLE

	Selected BL			Un-Selected BL			
	V_{WL}	V_{BL}	V_{SL}	V_{WL}	V_{BL}	V_{SL}	V_{NW}
PROGRAM	5V	-4V	FL	0V	FL	FL	2V
ERASE	-6V	0V	0V	0V	0V	0V	6V
READ	0V	0V	-2V	2V	-2V	-2V	0V

Fig. 13

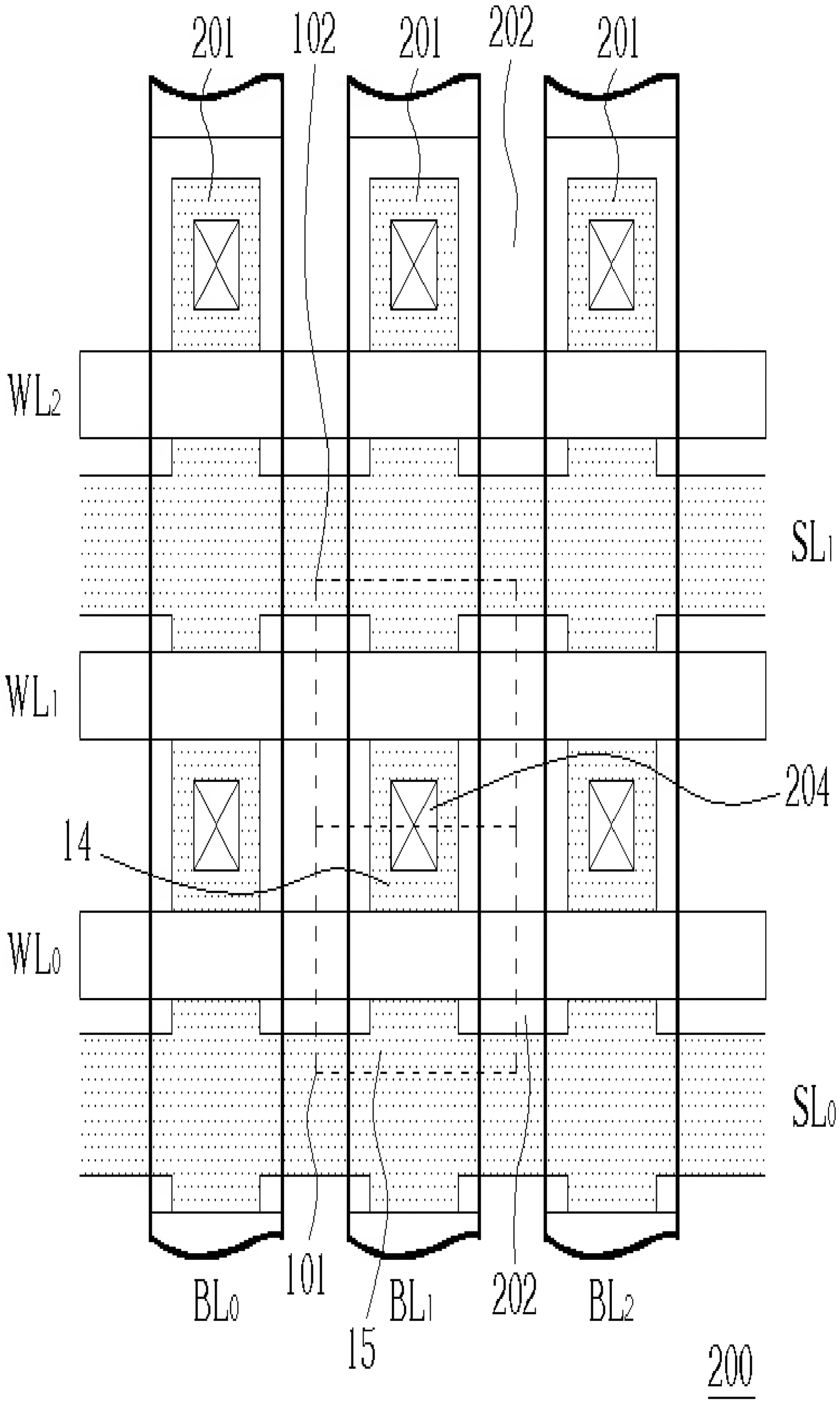

201
102
201
202
201
WL2
SL1
WL1
204
14
WL0
SL0
101
BL0
BL1
202
BL2
15
200

Fig. 14

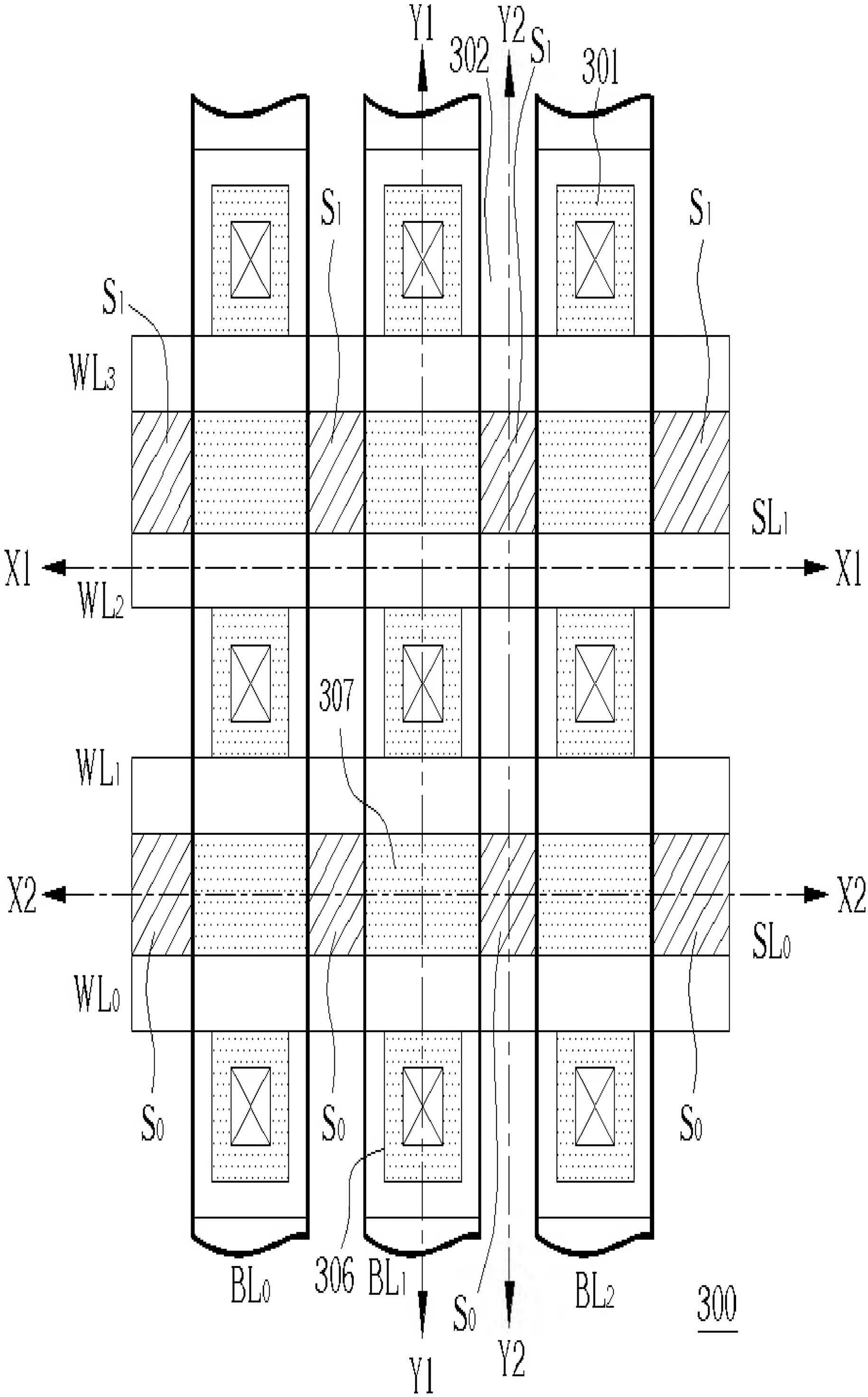
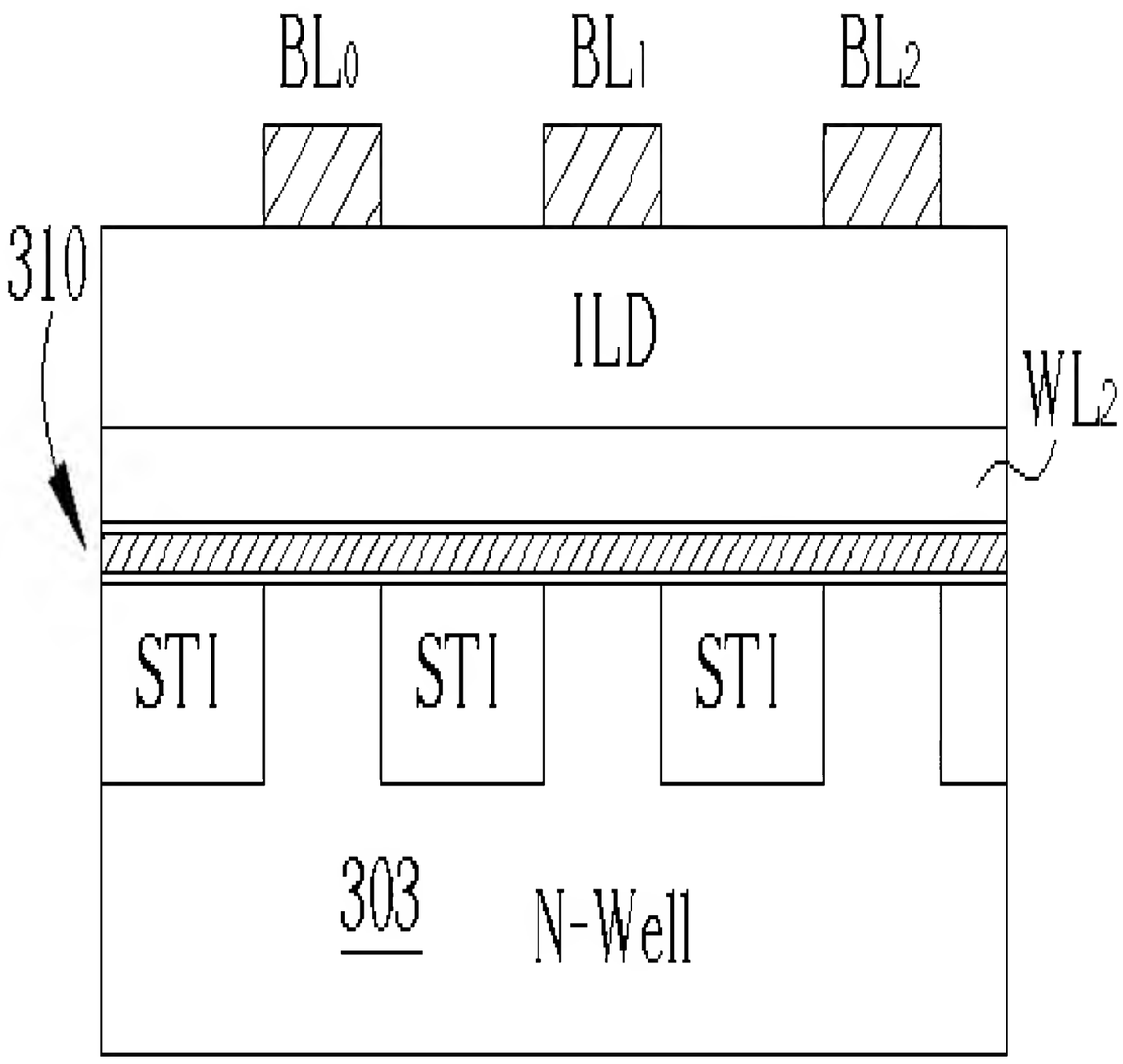
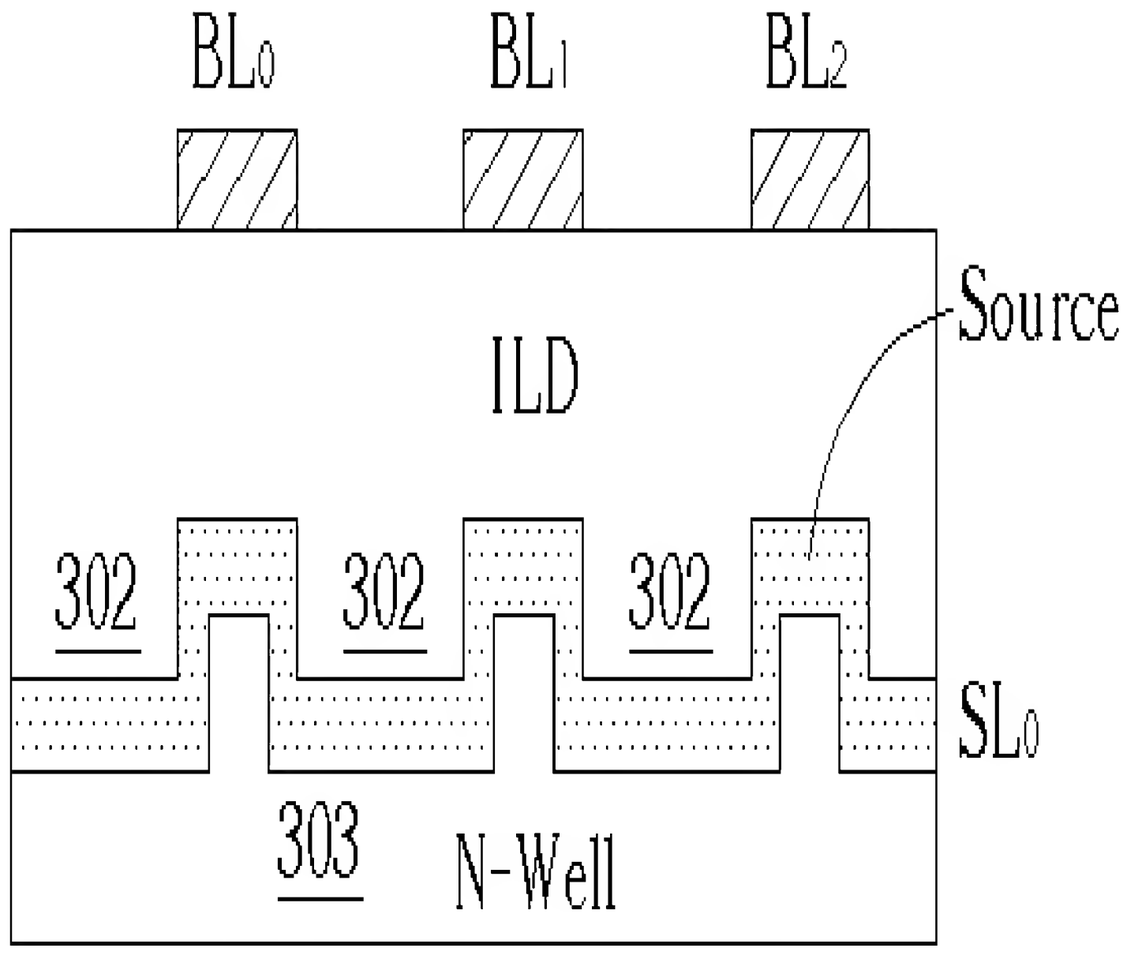

Y1
Y2
302
S1
301
S1
S1
S1
WL3
SL1
X1
X1
WL2
307
WL1
X2
X2
SL0
WL0
S0
S0
S0
306
BL0
BL1
S0
BL2
300
Y1
Y2

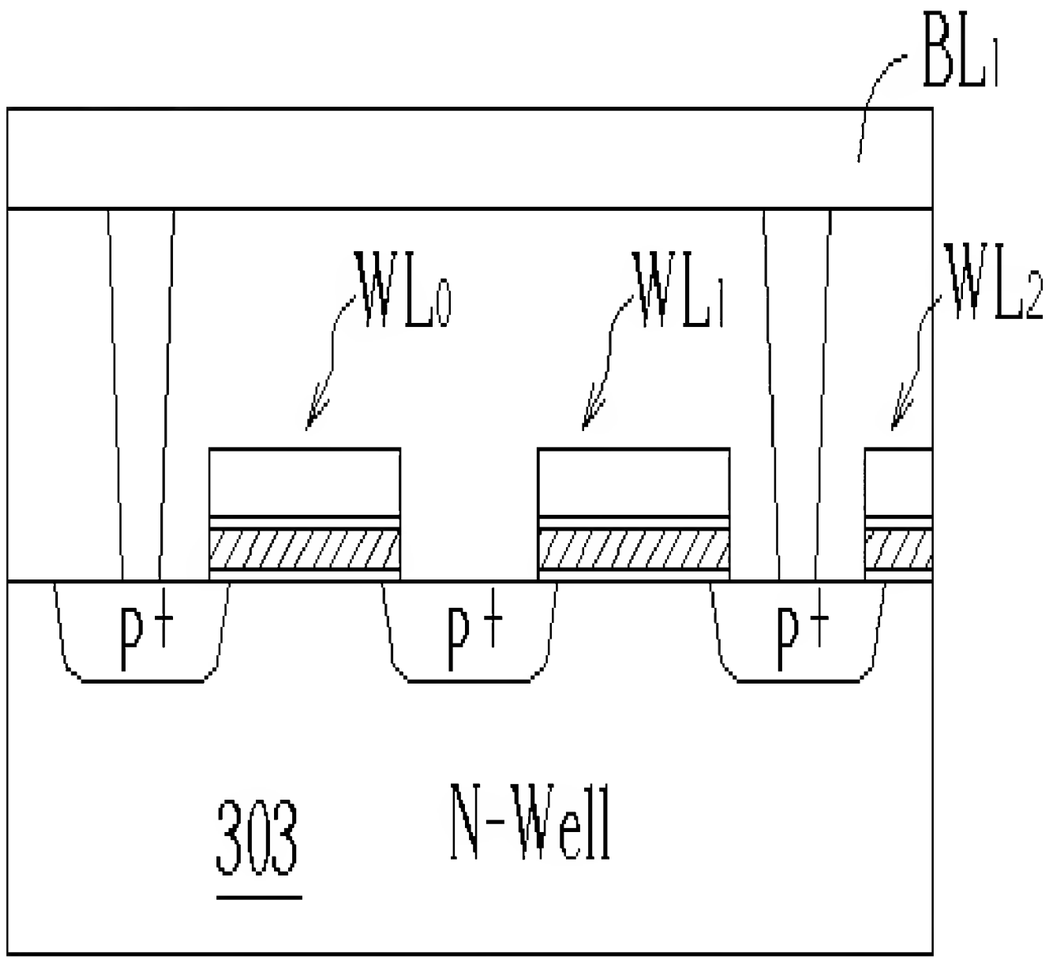
Fig. 15



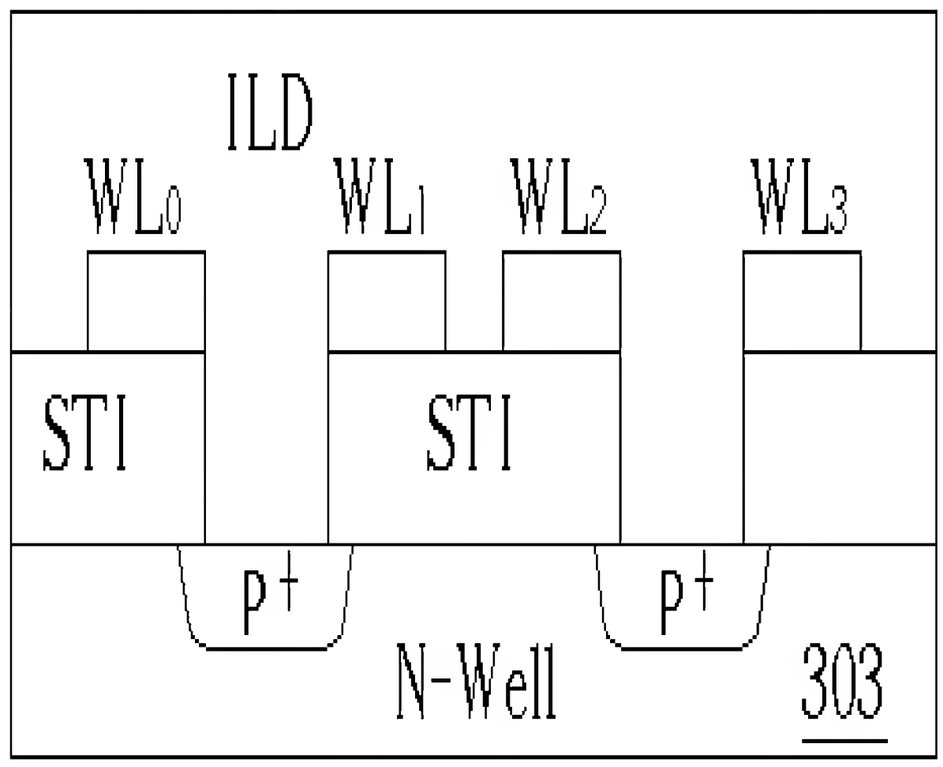
X1 direction



X2 direction



Y1 direction



Y2 direction

Fig. 16

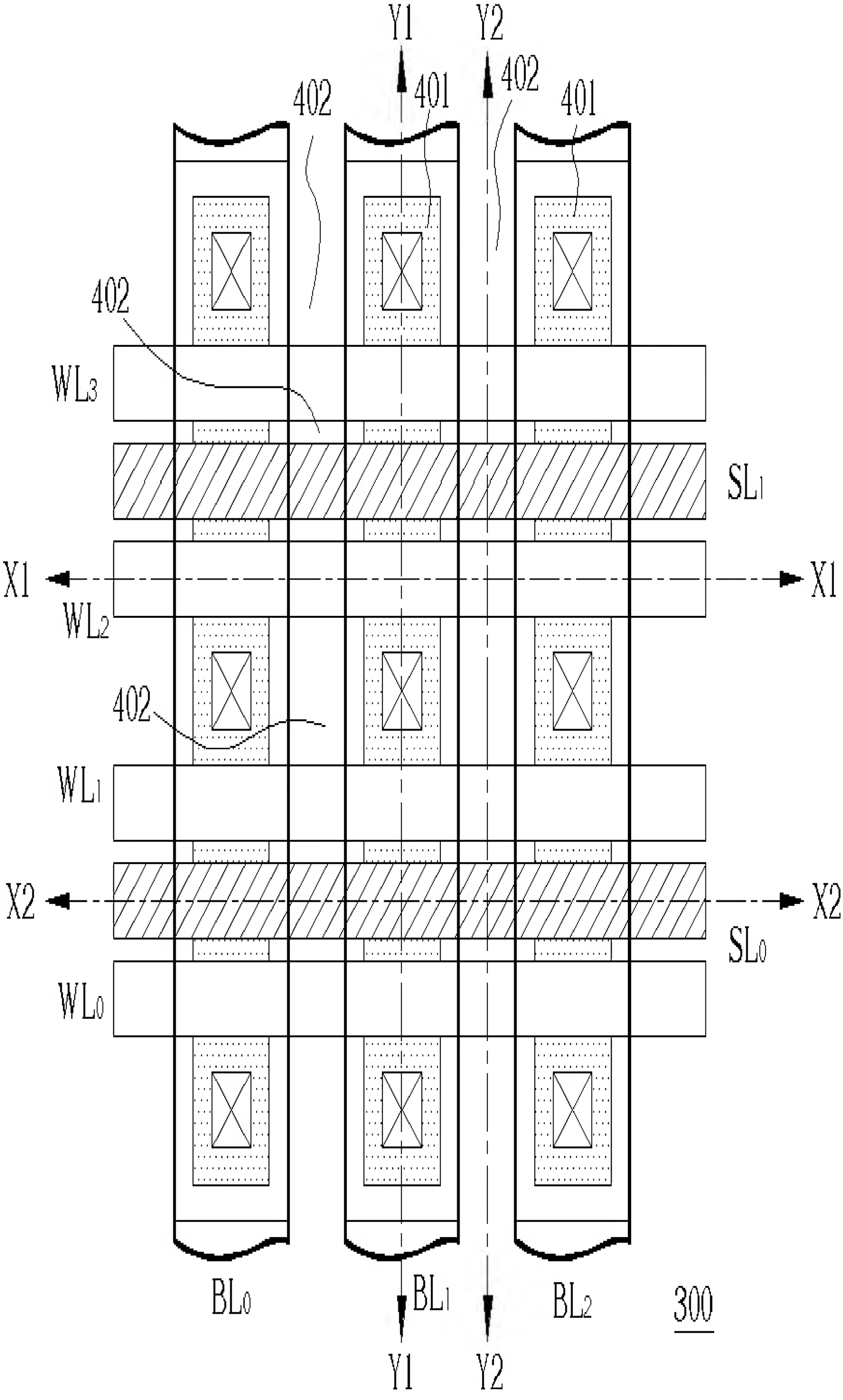
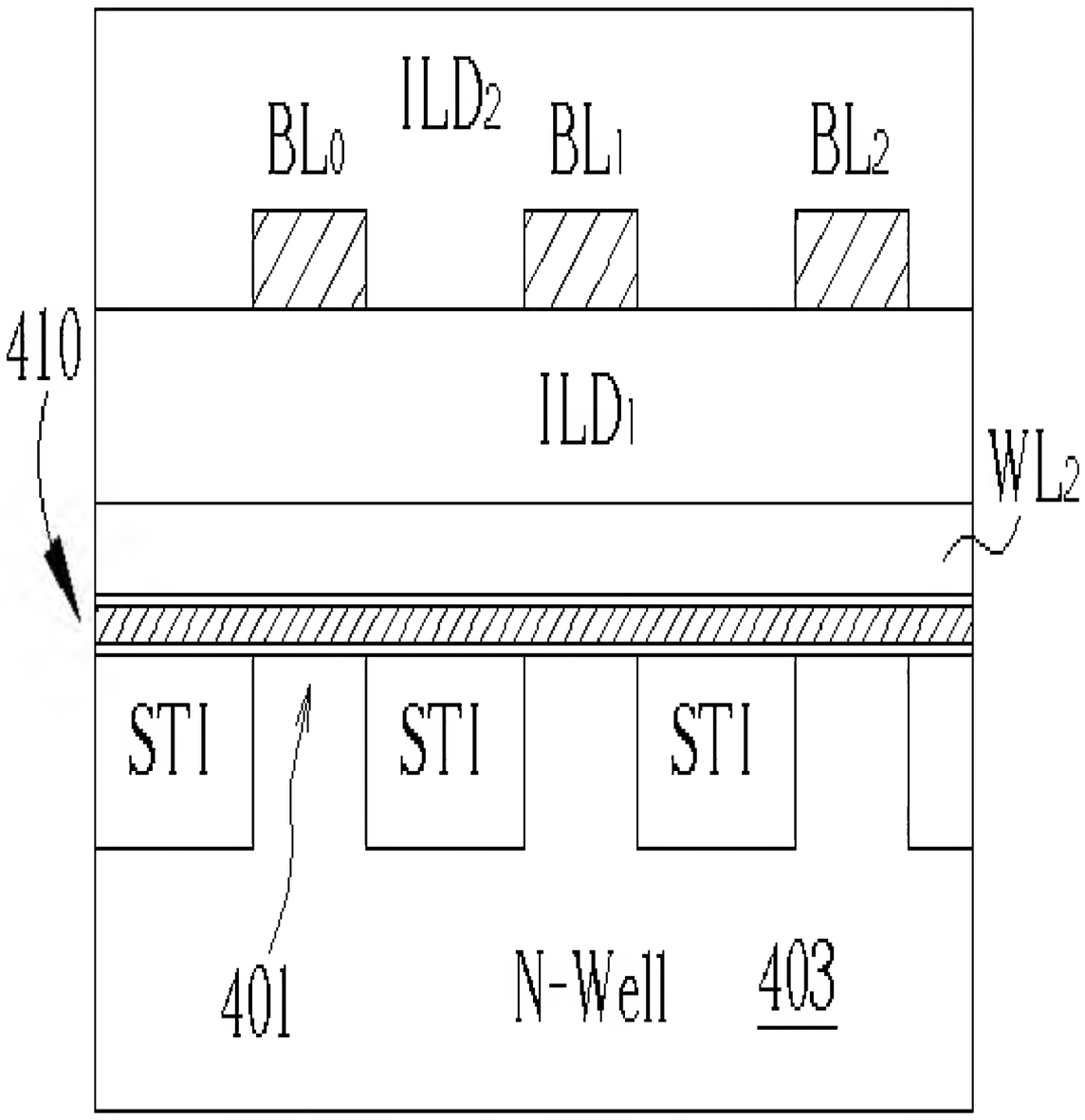
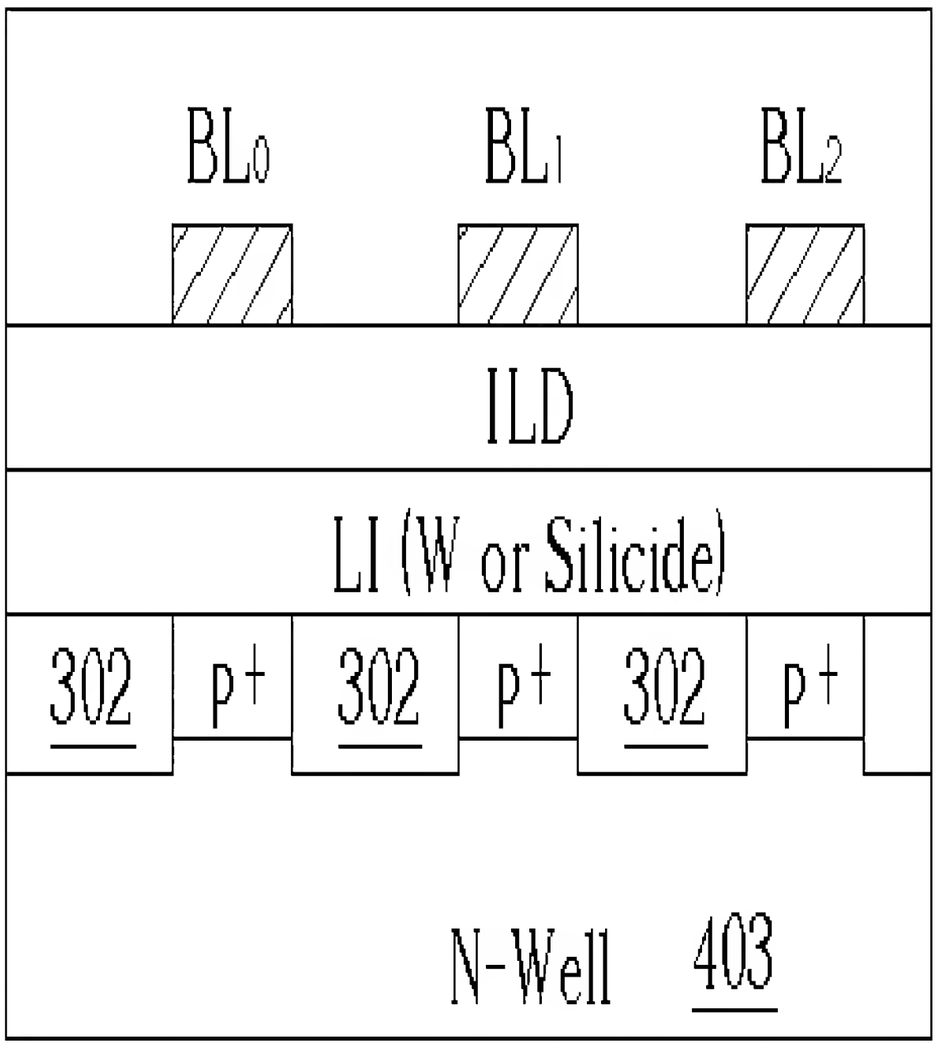

Y1
Y2
402
401
402
401
402
WL3
SL1
X1
X1
WL2
402
WL1
X2
X2
SL0
WL0
BL0
BL1
BL2
300
Y1
Y2

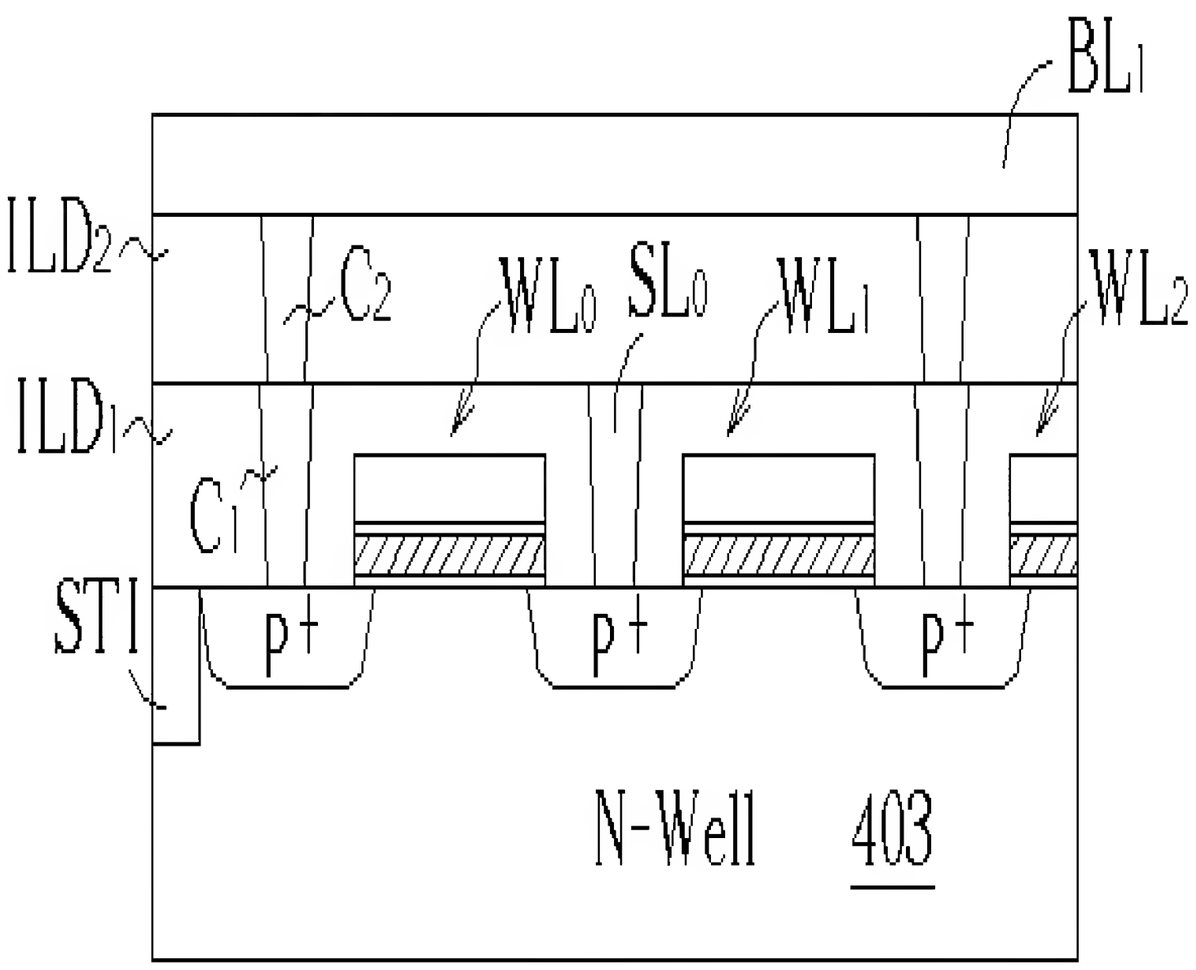
Fig. 17



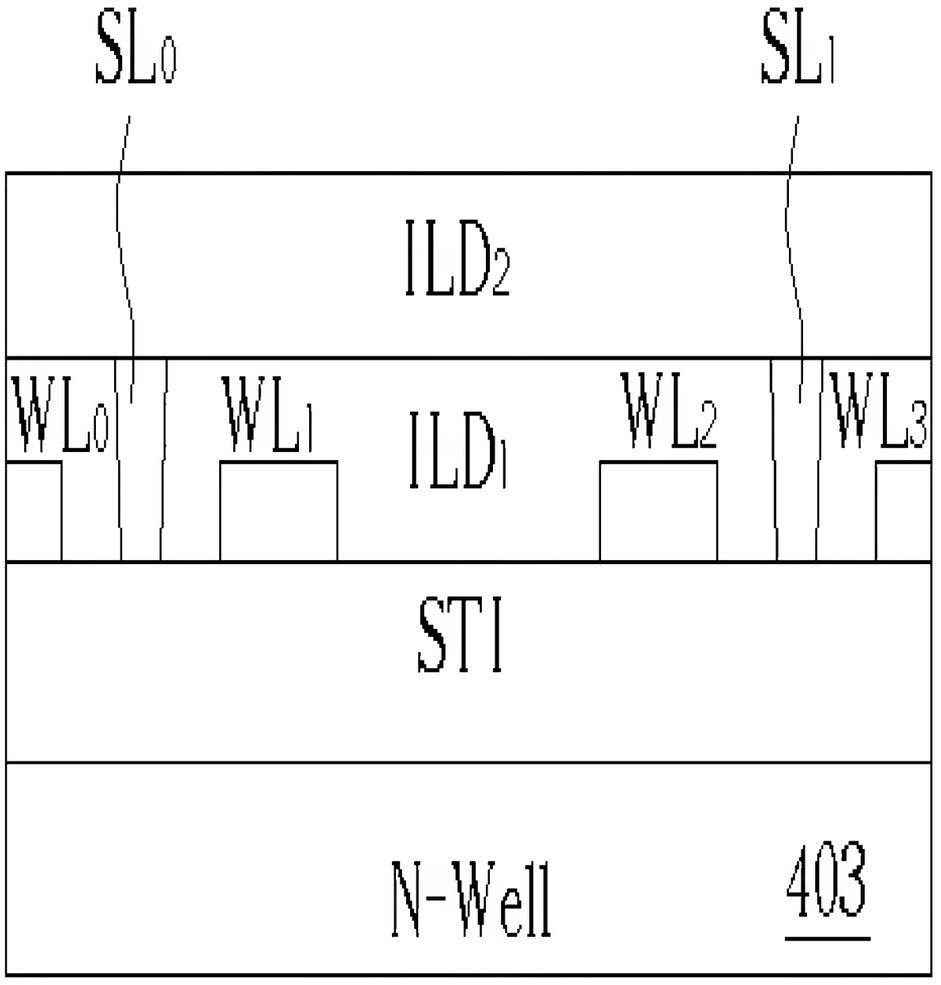
X1 direction



X2 direction



Y1 direction



Y2 direction

Fig. 18

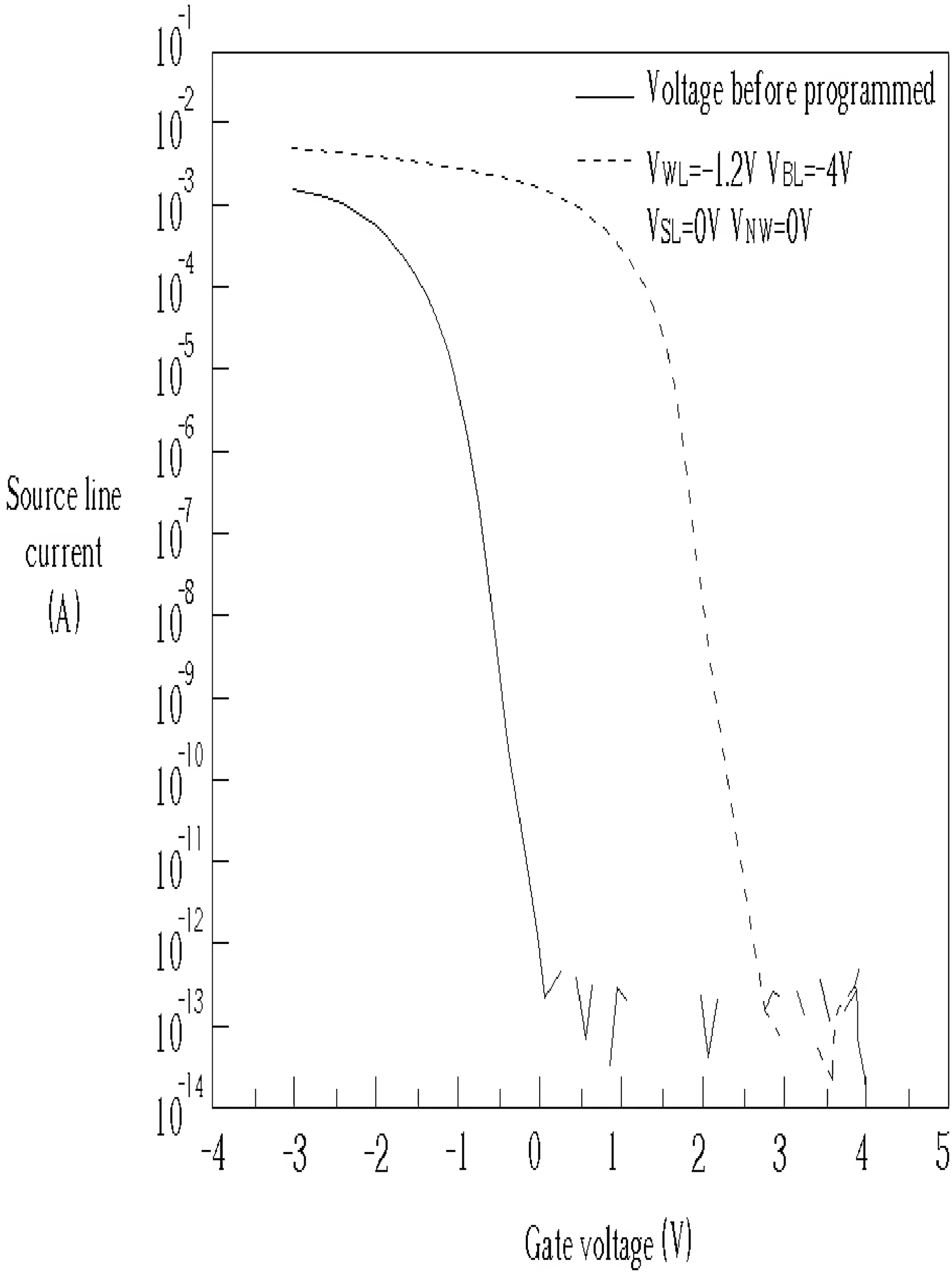

Voltage before programmed
V_{WL}=-1.2V V_{BL}=-4V
V_{SL}=0V V_{NW}=0V
Source line current (A)
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
-4
-3
-2
-1
0
1
2
3
4
5
Gate voltage (V)

Fig. 19

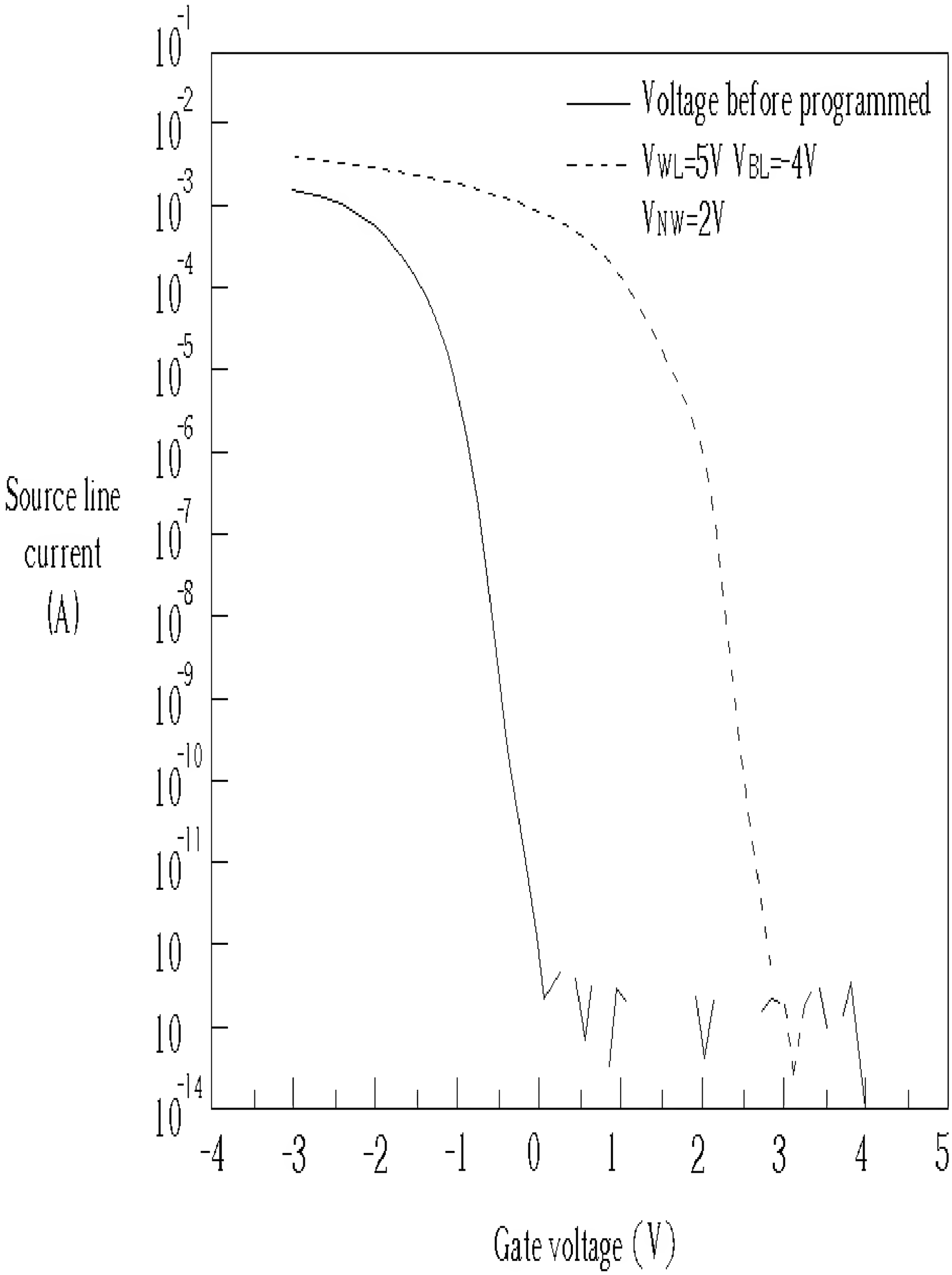

Voltage before programmed
V_{WL}=5V V_{BL}=-4V
V_{NW}=2V
Source line current (A)
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
-4
-3
-2
-1
0
1
2
3
4
5
Gate voltage (V)

Fig. 20